A Combined Length-of-Day Series Spanning 1832–1997

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The Earth's rotation is not constant but exhibits minute changes on all observable time scales ranging from subdaily to secular. This rich spectrum of observed Earth rotation changes reflects the rich variety of astronomical and geophysical phenomena that are causing the Earth's rotation to change, including, but not limited to, ocean and solid body tides, atmospheric wind and pressure changes, oceanic current and sea level height changes, post-glacial rebound, and torques acting at the core-mantle boundary. In particular, the decadal-scale variations of the Earth's rotation are thought to be largely caused by interactions between the Earth's outer core and mantle. Comparing the inferred Earth rotation variations caused by the various core-mantle interactions to observed variations requires Earth rotation observations spanning decades, if not centuries. During the past century many different techniques have been used to observe the Earth's rotation. By combining the individual Earth rotation series determined by each of these techniques, a series of the Earth's rotation can be obtained that is based upon independent measurements spanning the greatest possible time interval. In this study, independent observations of the Earth's rotation are combined to generate a length-of-day series spanning 1832–1997. The observations combined include lunar occultation measurements spanning 1832–1955, optical astrometric measurements spanning 1956–1982, lunar laser ranging measurements spanning 1970–1997, and very long baseline interferometric measurements spanning 1978–1998. These series are combined using a Kalman filter developed at JPL for just this purpose. The resulting combined length-of-day series will be presented and compared with other available length-of-day series of similar duration.